

An Agent-Based Model for Integrated Pest Management with Periodic Control Strategies

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Abstract:

We consider an agent-based model (ABM) for integrated pest management (IPM). The model incorporates stage structure for both the pest species and the predator species. The two control strategies of augmentation of the predator species and application of pesticide and the pest births occur periodically at possibly different frequencies. Moreover, the amount of augmentation depends on the ratio of the population densities of the pests and predators. We determine conditions under which pest eradication occurs and under which both species persist. We further investigate how varying the frequencies of the control strategies affects the amounts pesticide and augmentation needed to obtain pest eradication or persistence. To provide further insight to the dynamics of the ABM, we compare the model to analogous impulsive differential equation model that exhibits similar behavior, for which we prove conditions for the global asymptotic stability of the pest eradication solution and the permanence of the systems.

Keywords: Agent-Based Model, Integrated Pest Management, Impulsive Differential Equations